

data given by Stenzel are questionable in support of his thesis, despite the fact that the fossil record of the oysters is excellent. It appears that the Gryphaeidae are the sole ancestral stock of the Ostracea, and the Ostreidae arose from the Gryphaeidae no earlier than middle Jurassic time.

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BELLAXINAEA, A NEW SUBGENUS OF GLYCYMERIDIDS (PELECYPODA) FROM THE WESTERN HEMISPHERE

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ABSTRACT

The new pelecypod subgenus Bellaxinaea is proposed for a distinctive group of split-ribbed glycymeridids which can be allocated to the genus Tucetona. Bellaxinaea is confined to the tropical western hemisphere, and its geologic range is from late Eocene to Recent.

Woodring (1973, p. 521) recognized a distinctive stock of tropical American glycymeridids which he referred to as the group of *Glycymeris arctata*. Woodring noted that the species of this group generally increased in size from the Eocene to the late Miocene. He also discussed the relationships of several Oligocene and Miocene species.

As Nicol (1956) pointed out, most fossil and living species of glycymeridids can be separated into two major groups based on the type of radial ribs. The more ancient group is typified by *Glycymeris*, *sensu stricto*. This group has shown little change in the type of ribs since the inception of the Glycymerididae during the early Cretaceous. The radial ribs of this group are relatively flat with superimposed radial striae. Living specimens commonly have a luxuriant growth of hairlike periostracum. This group is found living in both tropical and temperate seas, but is not found where the yearly average temperature is less than 5° C. The second group is typified by the genus *Tucetona*, and the radial ribs are raised and are either simple or divided. Superimposed radial striae are never present, and there is little or no periostracum on living

specimens. This group does not appear before the Eocene and is almost exclusively confined to tropical seas. Woodring's group of *Glycymeris arctata* is clearly related to *Tucetona* on the basis of the radial ribs.

Family Glycymerididae Newton, 1922

Genus *Tucetona* Iredale, 1931

Subgenus *Bellaxinaea* new subgenus

Type species—*Arxinaea intercostata* Gabb, 1860

Description—Small to medium-sized glycymeridids; valve outline circular to subtrigonal, symmetrical; ratio of convexity to height of both valves commonly less than 0.55; beaks small, orthogyrate; ligament amphidetic, small; hinge plate strong, with high arch; teeth small and numerous, from 20 to 35 in number, central teeth under ligament present in mature specimens; radial ribs raised and numerous, on umbonal region or in immature specimens simple, later dividing one or more times and with secondary radial ribs sometimes forming in the interspaces between the primary ribs; crenulations on interior ventral margin medium-sized to large, about 15 to 20 in number, ends sometimes truncated and bifid, central portion of

crenulations may or may not be depressed.

Geologic range—Late Eocene to Recent.

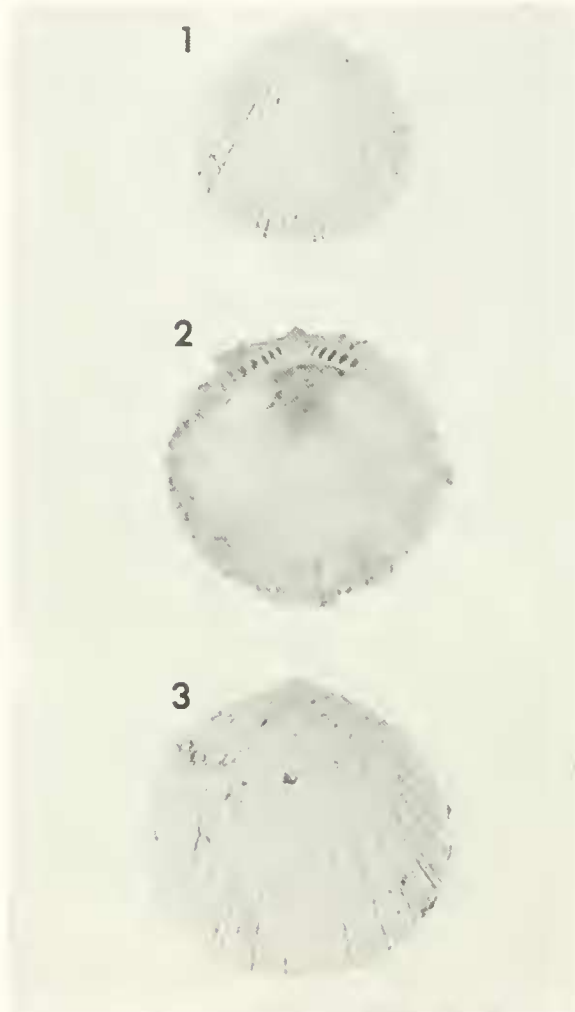
Geographic range—Tropical western hemisphere; Florida, Georgia, Mississippi, California, Trinidad, Brasil, Venezuela, Colombia, Panama, Costa Rica, Mexico.

The earliest species of *Bellarinaea* commonly have the greatest number of radial ribs, as, for example, *Axinaea intercostata*. In other words, these oldest species tend to have more splitting of the primary ribs and also more secondary radial ribs developed between the primary radial ribs. There are, however, some exceptions to this general rule. *Bellarinaea* has its greatest diversity of species during the Oligocene and Miocene.

One species that probably does not belong to *Bellarinaea* is *Axinaea bellasculpta* Conrad, 1860. The description is short and vague, and the species was never figured. The locality is simply stated as Mississippi. Unfortunately, Dall (1898, p. 607) synonymized *Axinaea bellasculpta* and *Axinaea intercostata* with *Pectunculus arctatus* Conrad, 1848. What probably led Dall to synonymize *Axinaea bellasculpta* with the other two species is Conrad's statement in his description of *Axinaea bellasculpta*, "radii in the middle of the disk trilineate." We borrowed the one specimen from the Academy of Natural Sciences of Philadelphia labeled *Axinaea bellasculpta* and *Glycymeris bellasculpta* (catalog no. 16399). Neither of the two labels in the box is in Conrad's handwriting, according to Ms. Elana Benamy, and it has not been ascertained that this specimen is Conrad's type. However, the ventral margin is densely crenulate, which fits Conrad's description. One label has "*Axinaea bellasculpta* Conr. = *hamula* Morton," and the label also has "Cretaceous and Mississippi" on it. The collector is stated as Spillman. The specimen appears to be a Cretaceous species, and the ribbing is much like that of *Glycymeris*, *sensu stricto*, although the outer surface of the shell is somewhat worn. One can, at present, regard *Axinaea bellasculpta* Conrad as a *species inquirenda*, but not synonymous with *A. arctata* Conrad.

Species allocated to *Bellarinaea*—Some of these species are synonyms, as Keen (1971) and Woodring (1973) have noted, and with detailed study there are likely to be no more than ten valid species.

1. *intercostata* Gabb, 1860. This species occurs in the *Rotularia vermoni* zone (Nicol and Jones, 1982) which is approximately equivalent to Puri's (1957) *Asterocyclina-Spirulaea vermoni* faunizone. This is the uppermost zone of the Crystal River Formation (Eocene) in peninsular Florida, and three specimens from this zone are figured herein (Figs. 1-3). This species also occurs in the Red Bluff and Mint Spring Forma-



FIGS. 1-3. *Tucetona (Bellarinaea) intercostata* (Gabb, 1860). 1. Exterior view, left valve, height 15.8 mm, length 16.3 mm, hypotype cat. No. 5705. 2. Interior view, right valve, height 16.6 mm, length 17.1 mm, hypotype cat. No. 5706. 3. Exterior view, right valve, height 20.4 mm, length 21.0 mm, hypotype cat. No. 5707. The three specimens are siliceous pseudomorphs and are housed in the invertebrate paleontology collection at the Florida State Museum. Locality—Gainesville West Quadrangle in a shallow quarry 0.5 mi. south of the intersection of State Road 26 and I-75, west of Gainesville, Alachua County, Florida, SW¼, Sec. 4, T. 10S, R. 19E.

tions (lower Vicksburg Group) lower Oligocene in Mississippi. For a more detailed discussion of the stratigraphy of the upper part of the Crystal River Formation in peninsular Florida, see Nicol, *et al.*, 1976.

2. *arctata* Conrad, 1848. Mint Spring and Byram Formations in Mississippi and Rosefield Formation in Louisiana, lower Oligocene (middle and upper Vicksburg Group). See Dockery, 1982, for the differences between *arctata* and *intercostata*.

3. *bicolor* Reeve, 1843, Mexico to Ecuador (Pacific), Recent. A synonym of *multicostata* Sowerby, according to Keen, 1971.

4. *canalis* var. *colombiensis* Weisbord, 1929. Colombia, Miocene.

5. *canalis democraciana* F. & H. Hodson, 1927. Venezuela, Miocene.

6. *chemnitzii* Dall, 1909. Mexico to Ecuador (Pacific), Recent. A synonym of *multicostata* Sowerby, according to Keen, 1971.

7. *cookei* Dall, 1916. Flint River Formation, Georgia. Uppermost Eocene to lower Oligocene. Also see Dockery, 1982.

8. *crashleyi* Maury, 1925. Brasil, late Miocene.

9. *lamyi* Dall, 1915. Florida, late Oligocene or early Miocene.

10. *lamyi tampae* Mansfield, 1937. Florida, late Oligocene or early Miocene.

11. *lloydsmithi* Pilsbry and Brown, 1917. Colombia, Miocene.

12. *lloydsmithi striatidentata* Nicol, 1945 = *lloydsmithi multicostata* Weisbord, 1929, not *multicostata* Sowerby, 1833. Colombia, Miocene.

13. *minor* Orbigny, 1846. Mexico to Ecuador (Pacific), Recent. A synonym of *multicostata* Sowerby, according to Keen, 1971.

14. *multicostata* Sowerby, 1833. Mexico to Ecuador (Pacific), Recent.

15. *schlenki* Nicol, 1947. Panama, Miocene.

16. *secticostata* Nicol, 1945. Costa Rica, Miocene.

17. *trilobocosta* Pilsbry and Brown, 1917. Colombia, Miocene.

18. *usiacurii* Anderson, 1929. Colombia, late Miocene.

19. *whaleyi* Nicol, 1947. California, late Oligocene or early Miocene.

Acknowledgments

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